



## RELIABILITY ASSURANCE PROGRAM DESCRIPTION

Implementation Date: 5/30/06

**APPROVAL:**



Facility Manager

5/23/06

Date

**CONCURRENCE:**



Maintenance Supervisor

5/23/06

Date



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**REVISION SUMMARY**

| <b>Revision Purpose (overall)</b>   |   |  |
|---|---|--|
| Updated to reflect actual Maintenance performance indicators, clarified plan's intent |   |  |
| <b>Specific Changes</b>   |   |  |
| <b>Location</b>   | <b>Description</b>                          | <b>Reason</b>  |
| Global  | Minor editorial and grammatical changes     | editorial and grammatical corrections                |
| Global  | Deleted unnecessary verbiage                | repetitive and excessive                             |
| Section 3.2   | updated goals and indicators                | to reflect actual Maintenance performance indicators |
| Section 4.2   | revised, clarified                          | to reflect the actual program functions              |
| Section 4.5   | deleted unnecessary and repetitive verbiage | repetitive and excessive                             |
| Section 5.0   | deleted                                     | this procedure has been implemented                  |
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## RELIABILITY ASSURANCE COMMITMENT

Foster Wheeler Environmental Corporation (FWENC) and the U.S. Department of Energy (DOE) share a mission statement on the Transuranic (TRU)/Alpha Low Level Waste Treatment Project (Project):

**Provide cost-effective, safe, environmentally compliant treatment and disposal of the TRU waste located on the Oak Ridge National Laboratory (ORNL) reservation.**

DOE sought "innovative solutions" and "sound, workable practices" in their evaluation and selection of FWENC for this Project. The FWENC process equipment design philosophy for the Project is that equipment will be designed for simplicity of operation, ease of maintenance, and minimization of secondary waste. The Project reliability assurance approach involves proven commercial practices and a strong emphasis on line management and worker experience and training. Project personnel will perform maintenance assignments on this project according to the provisions of this Reliability Assurance Program Description (RAPD). Planning for streamlined reliability-centered maintenance, initiated early in the facility design process, facilitates implementation of this philosophy and the accomplishment of the Project mission.

The Project definition of reliability is as follows:

**Reliability encompasses the design philosophy of high reliability components with condition based maintenance to ensure mission success while maintaining personnel exposures as low as reasonably achievable (ALARA).**

This RAPD outlines the approach the Project will employ to apply best maintenance practices in a way that provides an objective basis for confidence that we will successfully achieve the project mission.

**ACRONYMS/ABBREVIATIONS, TERMS AND DEFINITIONS****Acronyms/Abbreviations**

|         |  |
|---------|--|
| ALARA   | as low as reasonably achievable                        |
| CBM     | Condition-Based Maintenance                            |
| CM      | Corrective Maintenance                                 |
| CMP     | Corrective Maintenance Plan                            |
| DOE     | U.S. Department of Energy                              |
| FWENC   | Foster Wheeler Environmental Corporation               |
| MS      | Maintenance Supervisor                                 |
| MTs     | Maintenance Technicians                                |
| O&M     | Operations and Maintenance                             |
| OEE     | Overall Equipment Efficiency                           |
| OM      | Operations Manager                                     |
| ORO     | Oak Ridge Operations                                   |
| OSHA    | Occupational Safety and Health Administration          |
| PvM     | Preventive Maintenance                                 |
| PvMP    | Preventive Maintenance Plan                            |
| RAP     | Reliability Assurance Program                          |
| RAPD    | Reliability Assurance Program Description              |
| RCM     | Reliability-Centered Maintenance                       |
| SS SSCs | Safety-Significant Structures, Systems, and Components |
| SSCs    | Structures, Systems, and Components                    |
| TRU     | Transuranic  |
| USQ     | Unreviewed Safety Question                             |
| WOL     | Waste Operations Lead                                  |
| WPF     | Waste Processing Facility                              |



### Terms and Definitions

**Condition-Based Maintenance (CBM)** – predicting equipment problems by measuring equipment condition, using vibration, thermal, ultrasonic sensors, or lubrication analysis and making decisions relating to maintenance actions based upon the condition of the equipment.

**Overall Equipment Efficiency (OEE)** – standard performance indicator for measuring equipment performance for continuous improvement.

$$\text{OEE} = \text{Availability} \times \text{Yield}$$

$$\text{Availability} = \text{processing hours} - \text{downtime hours}$$

$$\text{Yield} = \frac{\text{amounts of processed waste} - \text{amounts of rejected waste}}{\text{amounts of processed waste}}$$

**Reliability-Centered Maintenance (RCM)** – a systematic approach to developing a maintenance strategy emphasizing doing the right work at the right time on the right equipment.

**Safety Significant Structures, Systems and Components (SS SSCs)** – structures, systems, and components designated as SS SSCs, identified in T-CM-FW-A-EG-004, Safety Significant Structures, Systems, and Components.



## 1.0 INTRODUCTION

### 1.1 Purpose

This Reliability Assurance Program Description (RAPD) describes the Foster Wheeler Environmental Corporation (FWENC) Reliability Assurance Program (RAP) for the Transuranic (TRU)/Alpha Low Level Waste Treatment Project (Project) under U.S. Department of Energy (DOE) Oak Ridge Operations (ORO) contract number DE-AC05-98OR22516, and serves the following purposes:

- establishes a Project commitment to reliability assurance
- serves as the description of the RAP and implementation strategy for an application of streamlined Reliability-Centered Maintenance (RCM) practices

The Waste Processing Facility (WPF) is a “non-reactor nuclear facility.” With this consideration, the WPF RAPD will implement a streamlined approach to RCM practices, utilized by commercial industry, in regard to facility maintenance while incorporating as low as reasonably achievable (ALARA) techniques.

### 1.2 Graded Approach

A graded approach shall be used in the application of the RAP to assure that the depth of detail required and the magnitude of resources expended for maintenance are commensurate with the WPF’s programmatic requirements for Safety Significant Structures, Systems, and Components (SS SSCs). The level of rigor applied to SS SSCs is greater than that applied to other WPF equipment. Work process for SS SSCs require detailed procedures that are in depth and assure quality. Work process for other WPF equipment does not require the same level of detail and relies on the experience of the performer for assurance of quality.

### 1.3 Application

The RAP is applied to SS SSCs and other WPF equipment based on a graded approach.

The scope and rigor of the individual assuring actions that collectively comprise the RAP are based on commercial industry and the graded approach. The RAP incorporates a streamlined approach to RCM while maintaining practices consistent with ALARA techniques. A Condition-Based Maintenance (CBM) approach is the result of this incorporation. Elements of that approach are as follows:

- designation of responsibility
  - development of procedures and work instructions based on manufacturers’ recommendations and commercial best practices
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- implementation of Preventive Maintenance (PvM) and Corrective Maintenance (CM) plans for SS SSCs and other WPF equipment
- integration of engineering reviews, as appropriate, to ensure technical reviews, post maintenance testing and acceptance criteria are defined
- performance of Unreviewed Safety Question (USQ) screens or determination as necessary
- utilization of qualified personnel, experienced in maintenance and operations
- spare parts inventory to support CBM

FWENC's technical approaches, commercially proven technology and a well-defined operating envelope are implemented by well trained, experienced personnel. This approach to reliability assurance provides confidence that the job is done right by integrating operations, maintenance and engineering reviews during work planning and performance throughout the entire work process. Personnel experienced in planning, reliability, engineering and maintenance disciplines carry out actions necessary to strengthen this approach.

Certain components are "run to failure" when it is safe and economical to do so, in accordance with SAE JA1011, Surface Vehicle/Aerospace Standard, "Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes," Section 5.8.2, issued August 1999.

## **2.0 REQUIREMENTS**

This RAPD provides guidance for maintenance of equipment and systems to be conducted in a manner to meet the following objectives:

- ensure the health and safety of the public and site personnel
- minimize adverse impacts to the environment
- prevent damage to equipment and systems
- ensure optimum equipment performance
- ensure cost effective safe operations
- minimize unscheduled equipment downtime

Routine equipment inspections will generate information used to balance ALARA exposure issues, cost of full replacement, implications of an unscheduled outage, and the manufacturers' recommended replacement intervals. Equipment maintenance will be

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scheduled in such a manner that it will have a minimal impact on production. Maintenance and inspection programs will be implemented to maximize reliability during the life of the WPF.

Scheduled maintenance will be defined in maintenance procedures or work instructions. Drawings will be used to determine how to isolate the component to ensure the safety of the worker and prevent equipment damage during maintenance activities. ALARA evaluations and appropriate engineering reviews shall be incorporated as deemed appropriate by the Maintenance Supervisor (MS) or Operations Manager (OM) into the procedures and instructions.

Before performing system maintenance, an activity hazard analysis will be used to determine the hazards presented by the work and the specific subsystem or component to ensure safety issues are identified and addressed. Hazardous sources will be isolated, and the system will be flushed, depressurized, drained or blown down before breaching hazardous or radioactive system piping. Ensure power sources are isolated before working on or near unguarded rotating equipment or before performing electrical work, except for testing which may require the equipment to be energized. Work on energized electrical systems is performed in accordance with T-CM-FW-P-IS-008, Electrical Safety.

### **3.0 PROGRAM OBJECTIVES AND GOALS**

#### **3.1 Objectives**

The RAP provides guidance for ensuring Structures, Systems, and Components (SSCs) are maintained in a manner that promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost effectiveness. Operations and Maintenance (O&M) personnel implement the RAP through the use of procedures or work instructions. The RAP accomplishes the following:

- high reliability of SS SSCs
  - planned PvM inspections of SSCs
  - identification of responsibility, authority, and accountability for the direction and management of the maintenance programs
  - establishment of a baseline for PvM activities based on specific equipment analysis prior to radioactive operations
  - promotion of a culture that utilizes preventive, predictive, and planned maintenance techniques, based on RCM practices utilized by commercial industry, to minimize unplanned/reactive maintenance
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- utilization of CBM techniques to monitor equipment conditions to minimize the cost and radiation exposure associated with industry-typical maintenance activities
- advocacy of a partnership between maintenance and operations

### 3.2 Goals

The organization and administration of the RAP relies on management actions to ensure implementation and control of maintenance activities. These actions establish and enforce procedures, observe and assess performance and hold personnel accountable for their performance. The RAP establishes achievable goals based on CBM performance indicators. The MS develops plans, with input from personnel involved in conducting maintenance activities. Plans are reviewed and approved by the OM.

Measuring key performance indicators for a CBM approach and comparing them to current goals will monitor the effectiveness of the RAP. Typical performance indicators include:

- Overall Equipment Efficiency (OEE)
- cycle time on PvM work orders
- cycle time on corrective maintenance work orders

Once measurable goals are established, maintenance effectiveness can be monitored and improvements achieved. The purpose of maintenance goals is to monitor and improve performance. Typical goals include:

- achieve >90% OEE
- zero Occupational Safety and Health Administration (OSHA) recordables during life of project
- achieve at least 90% planned PvM
- cycle time for unplanned/reactive corrective maintenance work orders is  $\leq 8$  days

## 4.0 PLANNED CONTROL ACTIONS

### 4.1 Responsibilities

The MS is responsible for the development, implementation, and execution of the RAP. In carrying out these responsibilities, the MS is assisted by the Mechanical Maintenance Technician(s) and the Instrumentation, Controls, and Electrical Maintenance Technician(s), each hereafter referred to as MTs. The MS also obtains assistance and expertise from Operations and Engineering personnel.



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4.1.1 The MS also performs the following functions:

- plans the overall RAP
- develops and maintains this RAPD
- develops, recommends, and maintains RAP-implementing plans, procedures, and instructions
- measures key performance indicators, based on a condition-based maintenance approach, and compares them to current goals to monitor the effectiveness of the RAP
- participates in the selection and training of personnel
- sets goals and objectives
- closely observes and assesses performance
- holds maintenance personnel accountable for their performance
- coordinates maintenance activities with operations and other facility organizations
- ensures timely completion of maintenance tasks while maintaining personnel exposures ALARA
- ensures lessons learned are incorporated into the RAP

4.1.2 Individual Personnel Roles and Responsibilities

Personnel with responsibilities identified herein are responsible for training to this RAPD and the identified implementing documents, prior to performing the activities described.

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## 4.2 Types of Maintenance

This section provides guidelines for establishing the proper relationship of the types of maintenance in the RAP. Many factors are considered in establishing an effective and efficient balance of the various types of maintenance. A thorough technical analysis using methods such as RCM and CBM are needed to establish this balance. Supporting information is provided in T-CM-FW-R-AD-003, Reliability and Maintenance Assessment.

The two types of maintenance are PvM and CM. Considering the Project's commitment to maintain personnel exposures to ALARA, PvM will not be applied to equipment in the radiation areas where design incorporates redundancies and run to failure options. Any CM needs will be selectively applied to equipment in radiation areas only upon the request of the OM or a Waste Operations Lead (WOL). The purpose of PvM is to eliminate or minimize unplanned failure. PvM may be applied to equipment whose failure can limit safe operation and result in unplanned outages or unacceptable costs to repair. Costs associated with PvM are offset by improved equipment reliability and availability and by reduced CM.

The elements needed to successfully implement a maintenance program include the following:

- an equipment list to aid in selecting and scheduling PvM
- scheduling PvM in a manner that allows consideration for performing related maintenance at the same time
- review and approval by the MS of PvM tasks that are deferred past a performance period or are missed entirely
- periodic review of the maintenance program to determine its effectiveness on overall equipment reliability

### 4.2.1 Preventive Maintenance Plan (PvMP)

A PvM program consists of routine tasks that are performed to prevent equipment failure. The scheduling and frequency of these tasks are based on contract and regulatory requirements, manufacturers' recommendations, equipment performance specifications, systematic analysis through predictive maintenance, ALARA considerations, and engineering recommendations. The program can be revised as history and trends indicate.

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The PvMP serves as the description of the Project PvM Program and defines the implementation strategy. The selection of required PvM tasks is based on WPF design, manufacturers' recommendations, and experience and industry practices. The objective of the PvM program is to increase the availability of equipment by eliminating hidden faults before equipment is disabled.

**4.2.2 Corrective Maintenance Plan (CMP)**

CM consists of those actions performed to restore failed or malfunctioning equipment to service per the current design. CM activities ensure that the condition that caused the failure is identified, corrected, and documented. Analysis is performed to determine the cause of failure and the corrective action to be taken, including feedback into the PvM programs, and maintenance training and qualification programs. The establishment of priorities for CM are based on Project mission and the relative importance of the equipment. CM is performed to accomplish timely repair of failed or malfunctioning equipment, systems, or facilities to restore their intended function or design condition.

The CMP serves as the description of the Project CM program and defines the implementation strategy. An objective of the CM program is to have planned outages that are scheduled from the results of CBM monitoring activities.

**4.3 Spare Parts Inventory Control**

Spare parts and consumables for routine tasks or equipment with routinely scheduled servicing (based on vendor recommendation or experience, such as lubrication, filter changes, cleaning, adjustments, and inspections) are typically pre-purchased or requested vendor stocked, as necessary. WPF design incorporates standardization and redundancy of equipment and allows for minimization of spare parts inventory. Critical spare parts for SS SSCs are ordered in advance or lead times researched for the purpose of evaluating appropriate times for procurement to minimize cost while ensuring WPF reliability. Project-related spare parts and consumables are stored in accordance with manufacturer's requirements, and with controlled access for the purposes of maintaining spare parts inventory and integrity.

**4.4 Personnel Training and Qualifications**

The selection process and applicable position-specific training ensure competence commensurate with responsibilities in accordance with T-CM-FW-P-AD-027, Personnel Qualification and Training.

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**4.5 Procedures and Work Instructions**

Maintenance procedures or work instructions are prepared and used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently. A balanced combination of written guidance, skilled employees, and work-site supervision is required to achieve the quality of work essential to safe and reliable WPF operations.

The graded approach is applied to the development of procedures and work instructions. Written procedures are used for each maintenance action on equipment that is designated safety-significant. Work instructions are typically written for routine maintenance on other equipment. A job-specific activity hazard analysis (AHA) is developed for tasks with specific hazards not covered in the general operations AHAs.

Prior to the start of any work, a determination will be made defining what procedures or work instructions will be required, if any. Procedures and work instructions are developed, reviewed, and approved by technically competent personnel. Procedures are more detailed and require interdisciplinary review, while work instructions are less detailed, relying heavily on performer skill, and only require a peer review. Procedures and work instructions are prepared and controlled in accordance with T-CM-FW-P-AD-061, Project Plans and Procedures.

**4.6 Records**

The maintenance records filing system is established to ensure readily accessible information is provided to support maintenance activities. Documents generated during maintenance activities are forwarded to Document Control, in accordance with T-CM-FW-P-AD-049, Project Files and Records Management. A copy is retained in the maintenance equipment history file.



**END OF DOCUMENT**